

- 5 1. A PEM fuel cell comprising:
a plurality of fuel cells, each fuel cell comprising:
first and second ribbed surfaces;
an electrolyte disposed between the first and second ribbed surfaces;
the first ribbed surface comprising an anode;
10 the second ribbed surface comprising a cathode; and
an enclosing layer affixed to a first edge of a plurality of first and second
ribbed surfaces, thereby creating a chamber between the surfaces of
alternating anodes and cathodes; and
a connecting layer affixed to a second edge of the first and second ribbed surfaces,
15 providing electrical connectivity between select anodes and cathodes.
2. The PEM fuel cell of claim 1 wherein the anode comprises a porous thin film
catalyst sputtered onto the first ribbed surface and the cathode comprises a
porous thin film catalyst sputtered onto the second ribbed surface.
3. The PEM fuel cell of claim 2, further comprising the porous thin film catalyst
20 deposited on a porous material.
4. The PEM fuel cell of claim 1, wherein the plurality of fuel cells are located in a
layer.
5. The PEM fuel cell of claim 4, wherein the plurality of fuel cells are substantially
trapezoidally shaped.
- 25 6. The PEM fuel cell of claim 4, wherein the electrolyte comprises a proton
conducting material.
7. The PEM fuel cell of claim 6, wherein the proton conducting material is selected
from the group consisting of plastic and teflon.
8. The PEM fuel cell of claim 4, wherein the connecting layer comprises a substrate
30 beneath a patterned metal layer containing pathways through which
electricity flows, the metal layer being covered with a dielectric material.
9. The PEM fuel cell of claim 8, wherein the substrate is selected from the group
consisting of silicon wafer, ceramic, and plastic.
10. The PEM fuel cell of claim 8, wherein the dielectric is polyimide.

- 5 11. The PEM fuel cell of claim 4, wherein a first chamber contains a fuel selected
 from the group consisting of hydrogen and methanol-water and a second
 chamber contains oxygen.
12. The PEM fuel cell of claim 1, wherein the plurality of fuel cells are located in a
 plurality of stacked layers.
- 10 13. The PEM fuel cell of claim 12, further comprising a side layer for providing
 electrical connectivity between the stacked layers.
14. The PEM fuel cell of claim 12, wherein the plurality of fuel cells are substantially
 trapezoidally shaped.
15. The PEM fuel cell of claim 12, wherein the electrolyte comprises a proton
15 conducting material.
16. The PEM fuel cell of claim 15, wherein the proton conducting material is selected
 from the group consisting of plastic and teflon.
17. The PEM fuel cell of claim 12, wherein the connecting layer comprises a substrate
 beneath a patterned metal layer containing pathways through which
20 electricity flows, the metal layer being covered with a dielectric material.
18. The PEM fuel cell of claim 17, wherein the substrate is selected from the group
 consisting of silicon wafer, ceramic, and plastic.
19. The PEM fuel cell of claim 17, wherein the dielectric is polyimide.
20. The PEM fuel cell of claim 12, wherein the side layer comprises a substrate
25 beneath a patterned metal layer containing pathways through which
 electricity flows, the metal layer being covered with a dielectric material.
21. The PEM fuel cell of claim 20, wherein the substrate is selected from the group
 consisting of silicon wafer, ceramic, and plastic.
22. The PEM fuel cell of claim 20, wherein the dielectric is polyimide.
- 30 23. The PEM fuel cell of claim 12, wherein a first chamber contains a fuel selected
 from the group consisting of hydrogen and methanol-water and a second
 chamber contains oxygen.
24. An electronic device using the fuel cell of claim 4 as a power source.

- 5 **25.** A method of preparing a PEM fuel cell assembly, comprising the steps of:
- providing a plurality of fuel cells, each fuel cell comprising a first and
 second ribbed surface;
- disposing an electrolyte between the first and second ribbed surfaces;
- sputtering a thin film catalyst onto the first ribbed surface to create an
10 electrode selected from the group consisting of an anode and a
 cathode;
- sputtering a thin film catalyst onto the second ribbed surface to create an
 electrode selected from the group consisting of an anode and a
 cathode;
- 15 affixing a top layer to a top edge of the first and second ribbed surfaces,
 thereby defining a chamber between consecutive ribbed surfaces;
 and,
- providing a patterned bottom layer to a bottom edge of the ribbed surface
 thereby providing electrical connectivity between select anodes and
20 cathodes.
- 26.** The method of claim **25**, further comprising the step of layering the plurality of
 fuel cells.
- 27.** The method of claim **26**, further comprising the step of stacking the plurality of
 fuel cells.
- 25 **28.** A PEM fuel cell comprising a plurality of fuel cells, each fuel cell comprising
 means for providing:
- first and second ribbed surfaces;
- an electrolyte disposed between the first and second ribbed
 surfaces;
- 30 the first ribbed surface comprising an anode;
- the second ribbed surface comprising a cathode; and
- enclosing layer means affixed to a first edge of a plurality of first
 and second ribbed surfaces, thereby creating means for a

5 chamber between the surfaces of alternating anodes and cathodes; and,

connecting layer means affixed to a second edge of the first and second ribbed surfaces, thereby providing means for electrical connectivity between select anodes and cathodes.

10 29. The PEM fuel cell of claim 28 wherein a first porous thin film catalyst means is sputtered onto the first ribbed surface and a second porous thin film catalyst means is sputtered onto the second ribbed surface.

30. The PEM fuel cell of claim 28, wherein the plurality of fuel cells are located in a layer.

15 31. The PEM fuel cell of claim 30, wherein the plurality of fuel cells are substantially trapezoidally shaped.

32. The PEM fuel cell of claim 30, wherein the electrolyte comprises a proton conducting material.

20 33. The PEM fuel cell of claim 28, wherein the plurality of fuel cells are located in a plurality of stacked layers.